Chapter 5
Semantic Priming in Monolingual Russian and Bilingual Russian (L1)-English (L2) Speakers in a Single Word Naming Task:
Semantic Priming in Russian

Evgenia Volkovyskaya
Middlesex University, UK

Ilhan Raman
Middlesex University, UK

Bahman Baluch
Middlesex University, UK

ABSTRACT

Identifying and exploring factors that influence bilingual language processing has been the topic of much psycholinguistic research. Semantic priming is typically used to examine semantic processing and refers to the phenomenon in which semantically related items (doctor-nurse) are processed faster and more accurately than semantically unrelated items (doctor-butter). The aim of the chapter is to address two key questions: 1) how the two languages of a bilingual are organised or stored and 2) how the two languages are processed. A review of the literature shows that there are currently no theoretical frameworks that explain Russian monolingual or

DOI: 10.4018/978-1-5225-4009-0.ch005

Russian (L1)-English (L2) bilingual storage or processing. Monolingual Russian speakers and bilingual Russian (L1)-English (L2) speaking university students were asked to name target words under related or unrelated conditions. The results show that the magnitude of the semantic priming effect was determined by L2 proficiency. The implications for these findings is discussed within the current bilingual theoretical models.

BILINGUALISM AND L2 PROFICIENCY

The ability to use spoken language to communicate with one another is a unique, inherent human characteristic that infants acquire without much effort. The additional ability to speak more than one language, i.e. *bilingualism*, because of contact with other communities, immigration and trade has been reported since antique times dating back to the Sumerians (Woods, 2006). In this respect, a widely accepted definition of bilingualism is '*both regular use and communicative competence*' in L1 (first language, native language, mother tongue) and L2 (second language) (Francis, 1999, p. 194). This very human behaviour has attracted much attention from philosophers to physicians throughout history and from psychologists in modern times.

From an evolutionary perspective, bilingualism can be perceived as a complex and a multifaceted process that involves the interaction of cultures, expression of social experience, and history of a particular people as well as the mechanism of interaction of languages (Roberts, 2013). Bilingualism makes contact with others possible, provides socialisation, forms tolerant attitude towards other cultures while it enhances cognitive abilities. At the same time, it is a prerequisite for the formation and perception of ethnic and social identity (Shi, 2007).

One aspect that has preoccupied researchers in the area of bilingual studies is the difficulties faced by a comprehensive classification of bilingualism that accurately defines an individual's skills in different modalities such as literacy and speech, performance and proficiency on the two languages they speak. The most common perception of a bilingual is someone who is almost equally fluent in two languages or at least proficient enough in their L2.

Various classification systems have been offered to explain the variation in fluency, competence, and order of acquisition for bilingual language use. For example, the degree of knowledge of languages has been labelled as either subordinate (when a bilingual speaks one language better than the other) and coordinate (or "pure", when a person speaks two languages in equal measure) (Grosjean, 1997). In addition, bilingualism has been described according to frequency of usage as either active (where both languages are used on a regular basis) and passive (the frequency of the use of one language dominates the other).

The degree of proficiency of the second language has also been used to classify bilinguals as receptive, reproductive, or productive where receptive bilingualism is defined as the ability to understand the subject of a non-native language (L2). Reproductive bilingualism involves the ability to competently reproduce spoken language in L2 and productive bilingualism is the ability to competently express thoughts and speech in L1 and L2 (Grosjean, 1997).

According to Bialystok and Hakuta (1994), a further definition of bilingualism depends on when L2 was acquired in relation to L1 leading to: 1) Simultaneous bilingualism when L1 and L2 were acquired in the same time (from speaking no languages directly to speaking two languages); 2) Early sequential bilingualism - L2 was learnt later than L1 in early childhood which represents a growing group of speakers worldwide; 3) Late bilingualism - L2 was acquired in adolescence or later.

One further aspect of bilingualism that has preoccupied researchers is the proficiency with which a bilingual speaks their second language (L2). This is because L2 proficiency could range from very basic communication to L1 level fluency; hence, it is a very important and an equally difficult factor to control for in bilingual studies. Additionally, bilingualism can be classified by levels of proficiency on production and reception (Bialystock, 2001). Productive bilinguals can speak and understand L2. Receptive bilinguals can understand both languages, but their abilities to produce L2 are limited.

A main objective of the current research is to understand lexico-semantic processes in bilingual Russian (L1) - English (L2) speakers in view of their L2 proficiency by using an objective measure; namely, the Schonell Reading Test (Schonell, 1971). However, it is difficult to find clear types of bilinguals, but rather a combination of types, which depends on particular features of language acquisition. In this respect, Grosjean (1997) considers that the bilingual mind is not a simple combination of two monolingual language systems, but a unique communication system that can use both languages or switch from one language to another depending on the subject and situation, and that bilinguals differ from monolinguals in terms of language reception and production. L2 proficiency therefore ought to be a central tenet in any psycholinguistic theoretical perspective that attempts to explain bilingual language processing.

The ability of the human cognitive system to store and organise language, and knowledge about words (phonological, semantic and orthographic representations) and to be able to retrieve those representations require multifaceted, interlinked, and complex mental processes. In the case of bilingualism, these processes are assumed to be even more complex as they are required to be executed for two languages. Of particular interest are two key questions raised within the bilingual literature context and related to the current chapter:

1. How the two languages of a bilingual are organised or stored; that is, whether each language is stored in one or more locations in bilingual memory
2. How the two languages are processed (i.e., what mental capacities are required to process each language)

Models of Bilingual Language Processing

A critical question that was raised in this respect during the 1980s was whether the two languages of a bilingual were stored in one or two memory stores. According to the separate store model (Potter et al., 1984), two separate lexicons for each language exist while according to the common store model (Paivio, Clark, & Lambert, 1988), only one memory store exists for both languages. Kroll and Stewart's (1994) Revised Hierarchical Model (RHM) integrated both accounts; that is, word association and concept mediation models, and proposed that both L1 and L2 words share conceptual representations (one store) as opposed to the word association model by Potter et al (1984) who suggest that L1 and L2 have separate representations for words (two stores) one for each language.

The RHM was primarily developed to explain the discrepancy in backward/ forward translation findings in late bilinguals taking proficiency into account (Kroll & Stewart, 1994). When bilingual speakers translate words from L1 to L2 (forward translation) they are assumed to use conceptual mediation via direct access to the word meaning. While translating backwards from L2 to L1, one must have access to the word meaning via lexical representations, which is by word association. Backward translation is usually faster than forward translation (e.g., Kroll & Stewart, 1994; Sholl, Sankaranarayanan, & Kroll, 1995).

A further assumption is that there is a large overlap in meaning between words in L1 and L2, especially in concrete words as they share more features compared to abstract words. Meanwhile, language-specific words and abstract words are not assumed to share representations in the bilingual mind. The more features in common L1 and L2 have, the easier the translation (Brysbaert et al., 2014). Schoonbaert, Duyck, Brysbaert, and Hartsuiker (2009) assumed that semantic priming can be understood by observing the overlaps L1 and L2 have in forward and backward translation.

The aim of the current research was to place the assumptions of the RHM in relation to lexical and conceptual links to the test an application to language processing in monolingual and Russian (L1) - English (L2) bilinguals.

Methods of Investigation

Historically, the bilingual version of the Stroop test attracted attention from early researchers when the focus shifted from case studies to experimental paradigms, (e.g., Preston & Lambert, 1969). In the traditional Stroop test (1935, Experiment 1) participants were asked to read words in black versus incongruent colour (e.g., GREEN printed in red ink as GREEN), and the participant is required to ignore reading the word out as 'green' and name the colour of the ink as 'red'. The aim was to examine the interference of activation of nontarget information on the target and a highly significant interference from incongruent words in naming colours supported this.

Variations of the Stroop task became popular to investigate the semantic relationship between bilingual's first (L1) and second language (L2) (e.g., Bril & Green, 2013; Marian et al., 2013; Roelofs, 2009; Rosselli et al., 2002; Sumiya & Healy, 2004). It is important to note the level of language proficiency can significantly influence interference. For instance, with proficient bilinguals language interference was greater in within-language colour naming than in between-language (e.g., Chen & Ho, 1986; Preston & Lambert, 1969; Dyer, 1971; Tzelgov et al., 1990).

Overall, between-language Stroop task has become a popular method to evaluate selective lexical processing when both L1 and L2 are activated simultaneously regardless language situation. However, one can argue that language interference measured by Stroop test alone is an artificial effect, when, under natural circumstances (reading) between-language interference may not happen (see MacLeod, 1991, for a review).

The lexical decision task in which participants are presented with a string of letters (words or nonwords) displayed on the computer screen and they must decide whether the letter string is a word or nonword by pressing a key is also widely used in bilingual research. Reaction time and the number of errors are measured. Evidence from lexical decision tasks with bilinguals also suggest that bilinguals activate words from both of their languages when making lexical decisions (DeGroot, Delmaar, & Lupker, 2000; Dijkstra, Van Jaarsveld & Ten Brinke, 1998).

However, in a study with English-Spanish bilinguals, Scarborough, Gerard and Cortese (1984) reported that the participants rejected English words as quickly as nonwords derived from English words (e.g., edan) and both were rejected more quickly than nonwords derived from Spanish. It was concluded that the participants only activated the target language. One criticism of the lexical decision task is that the reading process cannot be simplified to the by the choice between words and nonwords and hence this task is not fully reflects the reading process (Seidenberg & McClelland, 1989).

Another popular research method is the naming task which assumed to better reflect the natural reading. Naming tasks attempt to identify processes used in generating sound (phonology) from print (orthography), therefore directly activating orthographic (spelling), phonological (sound) and semantic (meaning) representations in the lexicon (Coltheart, 1978; Morton, 1969). One interesting research question in naming tasks is whether bilinguals activate phonological representations in the nontarget language during word naming.

In order to address this question, Jared and Kroll (2001) tested English-French and French-English bilinguals. Findings showed that phonological representations were simultaneously activated in both languages. However, this was dependent on several factors as follows: a) whether bilinguals were naming words in their dominant or less dominant language b) participants' fluency and c) experience with French d) whether English target words were named before or after the French distracters words (Jared & Kroll, 2001).

During the 1970s and 1980's, there was a surge of research that aimed to identify cognitive processes involved in semantic priming in order to establish a theoretical understanding of this robust phenomenon using different experimental paradigms such as lexical decision and naming tasks. In the classic semantic priming task, participants are presented with either semantically related word pairs (e.g., DOCTOR-NURSE) or unrelated pairs (e.g., DOCTOR–BUTTER), typically comprised of a prime-target and asked to name or make a word/non-word judgement of the second word (target) as quickly as possible.

A reliable finding is that naming or making judgments on the target word is faster and more accurate when the prime is related (DOCTOR-NURSE) than unrelated (DOCTOR–BUTTER). This phenomenon is called semantic priming (Meyer & Schvaneveldt, 1971). Semantic priming was of special interest because it provides an opportunity to manipulate the semantic associations between words in order to address two key questions that dominate bilingual research: i) how the two languages of a bilingual are organised or stored; that is, whether each language is stored in one or more locations in bilingual memory and ii) how the two languages are processed (i.e. what mental capacities are required to process each language).

The model of spreading activation is useful in explaining semantic priming. that is, the faster and more accurate retrieval of information (i.e., the target), from memory if related information (i.e., the prime, has been presented a short time before). According to Neely and Kahan (2001), spreading activation principle assumes that words in a given network are activated automatically; that is, the process is fast, occurs without intention, is involuntary, and can occur without conscious awareness. This is because semantically related concepts are assumed to form stronger links or may be stored closer together than those concepts that are unrelated (Neely, 1991).

When one node is activated, activation spreads along the network to other concept nodes that are located nearby. The semantic-priming effect is argued to arise because the activation of a semantically related prime word leads to shorter response times to the target word, since the distance between related a prime-target pair (e.g., drink-taste) is shorter than an unrelated prime-target pair (e.g. drink-swallow).

Monolingual studies under different semantic priming manipulations have shown a robust effect (for reviews, see McNamara & Holbrook, 2003; Neely, 1991), yet between-language semantic experiments show ambivalent results (see Altarriba & Basnight-Brown, 2007 for a review). Proficiency in L2 has been considered an extraneous variable which influences the outcome of bilingual research on semantic priming. The general assumption is that bilinguals who are proficient in both languages would show a larger semantic priming effect than those who are not (Basnight-Brown & Altarriba, 2007).

For the purpose of this research, semantic priming was employed in a series of monolingual Russian and bilingual Russian (L1) – English (L2) experiments. The semantic in semantic priming means that priming is caused by true relations of the meaning. Hence, the particular interest induces the exploration of semantic effects in a bilingual context. Semantic priming is traditionally the most common type of priming in psycholinguistic experiments, particularly in word naming tasks (Harley, 2013).

Russian Orthography and Psycholinguistic Research

Modern Russian is a widely spoken East Slavic language which belongs to the Indo-European family of languages. Estimates of the number of people who speak Russian as either a first or second language vary from 285 million speakers (Weber, 1997) to 455 million (Crystal, 2008). Russian is one of the six official languages of the United Nations.

The modern Russian alphabet is based on the Cyrillic alphabet and consists of 33 letters; 21 consonants, 10 vowels, and two silent letters (Iliev, 2013). Details of the alphabet together with letters, their names and approximate sounds in English are reported below in Table 1. The relationship between the letters of the alphabet and pronunciation in modern Russian is not phonological. Both derivational and inflectional morphologies are extremely rich. Derivation occurs primarily by means of prefixation and suffixation.

Historically there have been several attempts to change the orthography which was originally based on the ancient Greek alphabet where the aim was to translate religious Greek texts into the Slavic language. By the order of the Byzantine Emperor Michael III at around 863 AD, brothers Cyril and Methodius from Thessaloniki created a new script called Glagolitic that originally contained 24 letters of Greek

Table 1. Russian Cyrillic alphabet

Letter	Name	Letter Sound	Approximate English Sound in Bold	Russian Example, Romanization, Meaning
Аа	а [a]	/a/	f**a**ther	**а**нана**а**с – “**а**нана**а**s” - pineapple
Бб	бэ [bɛ]	/b/ or /bʲ/	**b**ig	**б**елка – “**b**elka” – squirrel
Вв	вэ [vɛ]	/v/ or /vʲ/	**v**ase	**в**ода – “**v**oda” - water
Гг	гэ [gɛ]	/g/	**g**et	**г**де – “**g**de” - where
Дд	дэ [dɛ]	/d/ or /dʲ/	**d**og	**д**ень – “**d**en’”-day
Ее	е [je]	/je/, / ʲe/or /e/	**ye**llow	**не**бо – “**ne**bo” - sky
Ёё	ё [jo]	/jo/ or/ ʲɵ/	**yo**ghurt	**ёж** – “**yo**zh” – hedgehog
Жж	жэ [ʐɛ]	/ʐ/	trea**s**ure	**ж**ена – “**zh**ena” – wife
Зз	зэ [zɛ]	/z/ or /zʲ/	**z**one	**з**има – “**z**ima” - winter
Ии	и [i]	/i/ or / ʲi/	h**e**	**и**кра – “**i**kra” - caviar
Йй	и краткое [i ˈkratkəɪ]	/j/	bo**y**	свой - “swo**i**” - my
Кк	ка [ka]	/k/ or /kʲ/	**k**eep	**к**амера – “**k**amera” - camera
Лл	эл or эль [ɛl] or [ɛlʲ]	/l/ or /lʲ/	**l**oose	ли**л**ия – “**l**i**l**iya” – lilly
Мм	эм [ɛm]	/m/ or/mʲ/	**m**irror	**м**есто – “**m**esto” - place
Нн	эн [ɛn]	/n/ or /ɲ/	**n**ight	**н**ебо – “**n**ebo” - sky
Оо	о [o]	/o/	c**o**re	**о**но – “**o**no” - it
Пп	пэ [pɛ]	/p/ or /pʲ/	**p**arrot	**пеп**ел – “**pep**el” - ash
Рр	эр [ɛr]	/r/ or /rʲ/	rolled **r** **r**iver	**р**ыба – “**r**yba” - fish
Сс	эс [ɛs]	/s/ or /sʲ/	**s**un	**с**ело – “**s**elo” - village
Тт	тэ [tɛ]	/t/ or /tʲ/	**t**reat	**т**у**т** – “**t**oo**t**” - here
Уу	у [u]	/u/	s**oo**n	**у**ж – “**u**zh” - adder
Фф	эф [ɛf]	/f/ or /fʲ/	**f**inger	**ф**он – “**f**on” – background
Хх	ха [xa]	/x/	**h**at	**х**леб – “**h**leb” - bread
Цц	це [tsɛ]	/t͡s/	**c**elsius	**ц**апля – “**ts**aplya” – heron
Чч	че [tɕe]	/t͡ɕ/	**ch**air	**ч**ас – “**ch**as” - hour
Шш	ша [ʂa]	/ʂ/	**sh**ark	**ш**елк – “**sh**elk” - silk
Щщ	ща [ɕɕж]	/ɕɕ/	**sh**eer	**щ**ека – “**sch**eka” - cheek
Ъъ	твёрдый знак [ˈtv’ərdij znak]	-	Silent	объект – “ob**’**ekt” - object
Ыы	ы [ɨ]	[ɨ]	Ros**e**s	**ты** – “*ty”* – you
Ьь	мягкий знак [ˈm’yagkɪj znak]	-	Silent	семь – “sem**’**” - seven
Ээ	э [ɛ]	/ɛ/	s**e**t	**э**кран – “**e**kran” - screen
Юю	ю [ju]	/ju/ or/ ʲʉ/	**u**nited	**ю**ла – “**yu**la” - whirligig
Яя	я [ja]	/ja/ or/ ʲж/	**ya**rd	**я**блоко – “**ya**bloko” - apple

alphabet and 19 letters specific to the Slavic language (Iliev, 2013). Thus, the modern Russian alphabet is derived from the Old Slavic Cyrillic alphabet, which was borrowed from the Bulgarian Cyrillic and became widespread in ancient Russia. At that time, Russian alphabet consisted of 43 letters. Later, four new letters were added, and 14 letters were at different times excluded as unnecessary (Barhudarov & Dosicheva, 1940; Iliev, 2013).

According to Kerek and Niemi, (2009a) the structure of the Russian orthography is complicated by exceptions and hierarchy of system of rules. The complexity of the language lies in its morphology. One of the main features of the grammatical structure of the Russian language is a mandatory change in the form of words according to the gender, number and other factors, and in the formation of phrases and sentences these words has to be coordinated accordingly. The primary means of producing synthetic forms of words in the Russian language is the ending. Endings are formed by means of the form of nouns, adjectives, numerals, pronouns. In most cases, the endings turn out to be syncretic; that is expressing more than one grammatical meaning.

Despite the complex orthography, Russia had one of the highest levels of adult literacy in the world in 2009 (Huebler & Lu, 2013). There are a number of features of Russian orthography and morphology that affect the process of literacy acquisition (Cubberley, 2002; Kornev, Rakhlin, & Grigorenko, 2010). This is partly attributed to the Russian letter-sound correspondences which involve a small number of context-dependent rules which can be difficult for beginner readers.

For example, the two auxiliary signs, the "soft" and "hard" signs which make the letters in words to be read in the different ways depend on the position of "soft" and "hard" signs in the word.

Moreover, a number of words contain the "jotated vowels" е (je), я (ja), ю (ju), and ё (jo). These vowels [j] correspond with other letters ([e], [a], [u] and [o] respectively) after the consonants and can change palatalization of consonants and the quality of the vowel. Russian approach to reading pedagogy helps accommodate these complexities with syllable-based approach to reading (Kornev, 1995, 2003; Egorov, 2006). Russian orthography is reported to be more phonemic in comparison to English (Grigorenko, 2012) and is morphologically very complex. Phonetic modifications, consonants and a number of irregularities prevent readers to perceive a morpheme as a distinct unit (Kerek & Niemi, 2009b).

Diversity of languages provides a platform from which their properties and characteristics of specific features can be examined in bilingual research. This has led to a large body of research in different language pairs (e.g., Italian (L1) - English (L2), (Tabossi and Laghi, 1992); Russian (L1) - English (L2), (Abu-Rabia, 2001); Spanish (L1) - English (L2), (Rosselli, Ardila, Santisi, Arecco, Salvatierra, & Conde,

2002); Greek (L1) - French (L2), (Voga & Grainger, 2007); Greek (L1) - English (L2), (Niolaki, Masterson, & Terzopoulos, 2014).

The Russian language is one of the most widely used languages, but research based on the study of the Russian language is relatively small (Kerek & Niemi, 2009b). Language features that combine the complexity and regularity is what makes the Russian writing system important for between-language research, particularly with English as there are shared features between Russian (Cyrillic and Roman) and English (Roman) orthographies. As can be seen in Table 2, Modern Russian alphabet is a mixture of Cyrillic and Roman orthographies and consist of 33 letters: six letters are orthographically and phonologically shared with the English (Roman) writing system; seven letters are orthographically shared, but phonologically unique; a total of 14 letters are orthographically unique, but phonologically shared, and six Cyrillic letters are orthographically and phonologically unique.

The increased world-wide use of Russian along with the wave of immigration of the Russian-speaking population in the last 20 years makes it essential to understand the processes of being a Russian (L1) - English (L2) bilingual speaker. One of the few psycholinguistic studies on Russian bilingual language processing is reported by Abu-Rabia (2001) where the relationship between Russian and English orthographies was tested. Participants were bilingual Russian (L1) - English (L2) speakers. They were tested on working memory, spelling, visual and phonological conditions, orthographic skills, word attack and word identification. Orthographic skills showed correlation within-languages, but not between-languages. Additionally, phonological and spelling skills in Russian (L1) seem to be predictors of word identification in English (L2).

In another study, Brill and Green (2011) recruited bilingual English (L1) – Russian (L2) speakers to test whether in a Stroop test bilingual speakers ignore one language when they switch to the other language. English (L1) speakers who formally studied Russian as L2 were presented with a within-language English Stroop test and a between-language Russian Stroop test. The results showed a bigger interference effect for English (L1) than for Russian (L2), while bilingual speakers demonstrated equally large interference effect for both English (L1) and Russian (L2). These results were taken as evidence to support the assumption that bilinguals access both their languages simultaneously.

Recent developments saw the emergence of the first normative data in Russian. Tsaparina, Bonin and Meot (2011) used the colour version of the Snodgrass and Vanderwart (1980) pictures (Rossion & Pourtois, 2004). This set of pictures has been normed and used for research in different languages, such as Turkish (Raman, Raman, & Mertan, 2014), Spanish (Sanfeliù & Fernandez, 1996), British English (Barry, Morrison, & Ellis, 1997), French (Alario & Ferrand, 1999), Icelandic (Pind, Jónsdóttir, Tryggvadóttir, & Jónsson, 2000), Italian (Nisi, Longoni, & Snodgrass,

2000), Japanese (Nishimoto, et al., 2005), Chinese (Weekes et al., 2007), and Modern Greek (Dimitropoulou et al., 2009), and others.

The colour version was successfully used in a number of psycholinguistic studies: picture-naming study in Chinese (Weekes et al., 2007); picture naming in English (Therriault, Yaxley, & Zwaan, 2009); norms for name agreement, AoA, and visual complexity were collected in Modern Greek (Dimitropoulou et al., 2009) and in a free-recall task in Turkish (Raman et al., under review). Tsaparina and colleagues (2011) reported norms for name agreement, image agreement, conceptual familiarity, imageability, and age of acquisition in Russian. The role of AoA on monolingual Russian and bilingual Russian (L1) – English (L2) free-recall were also recently reported (Volkovyskaya, Raman and Baluch, under review).

Current Study

Given the general lack of literature on lexico-semantic processes in Russian speakers, the attention first turned to monolingual Russian speakers in order to gather evidence and to establish a theoretical framework of lexico-semantic processes in Russian.

Experiment 1

Design

In a repeated measures design, monolingual Russian participants were required to name target words under related and unrelated prime-target experimental conditions. The naming RTs (ms) and errors were recorded.

Participants

A total of 20 adult, monolingual Russian speaking students from St. Petersburg State Paediatric Medical University in St. Petersburg, Russia took part in Experiment 1. All the participants were monolingual Russian speakers with normal or corrected to normal vision.

Materials

Care was taken to use only very common or frequent words because a variation in word frequency has been reported to influence the semantic priming outcomes (see Lemhöfer et al., 2008 for a review); therefore, word frequencies were taken from the Word Frequencies Dictionary of modern Russian language which was based on a collection of texts of the Russian National Corpus, representing the modern Russian language for the period of 1950-2007 (Lyashevskaya & Sharov, 2009).

Materials comprised of either 21 semantically related pairs [врач - медсестра (nurse)] and [собака (dog)-кошка (cat)] or 21 unrelated pairs [врач (doctor) – кошка(cat)] which were presented using SuperLab software.

Procedure

A practice trial of four primes and four targets were run to familiarize participants with the procedure and the equipment. The participants were tested one at a time in a quiet laboratory at St. Petersburg State Paediatric Medical University and were seated approximately 60 centimeters from a computer screen and instructed to name the target words as quickly and as accurately as possible.

SuperLab experiment generator was used to present the stimuli and to record naming RTs via an SV-voicebox. First, a fixation point was presented on the computer for 500ms, followed by a 250ms blank, and then by the prime word in black font size 18 against white background in the middle of the screen for the next 500ms. The target followed the prime on the screen and disappeared after a response was made or after a 1000ms deadline to respond before the next trial began.

If participants did not name the target within the deadline, this was recorded as NR (no response). Finally, the related and unrelated conditions were counterbalanced to prevent order effects. The participants' number of errors was recorded by the experimenter.

Results

Data were analysed using descriptive statistics (see Table 2) and a repeated measures t-test. The SD values similar indicating homogeneity of variance. A difference of 25ms between related and unrelated conditions was found to be statistically significant. The results showed a significant semantic priming effect for monolingual Russian speakers, $t(19) = 2.6$, $p<0.01$. The error rates were less than 1% and therefore were not entered into analyses.

Table 2. Descriptive statistics showing naming RTs in milliseconds and SD in related and unrelated prime-target conditions in Experiment 1 for Russian monolinguals

Experimental Condition in Russian	Mean RTs	SD
Related	515	49
Unrelated	540	44
Magnitude of semantic priming	25	

Interim Discussion

The aim of Experiment 1 was to establish the existence of semantic priming effects in native Russian speakers in a naming task. As can be seen from the results reported above, a significant semantic priming effect is reported here for the first time in Russian adds to the body of literature in different languages. This was predicted by automatic spread of semantic network activation (Collins & Quillian, 1969) hypothesis and is taken to further support the universality of this phenomenon in the human mind irrespective of language.

Armed with this result, the focus turns to Experiments 2 and 3 in an attempt to examine within-language semantic priming in Russian (L1) - English (L2) bilinguals. This query is in line with the current trends in bilingual research as discussed under discussion.

Experiment 2

Method

Experiment 2 was a replication of Experiment 1 in which 20 bilingual Russian (L1) - English (L2) speaking university students were recruited from Middlesex University, London, in the United Kingdom. The participants were required to respond to the same stimuli as in Experiment 1 in Russian (L1) and were tested one at the time in a laboratory setting at Middlesex University using SupeLab software. Naming RTs and errors were recoded the same way. None of participants were enrolled in the English-as-a-Second-Language program or in intensive English courses.

Three possible outcomes were predicted: i) semantic priming effect will be the same for monolingual Russian (L1) and Russian (L1)-English (L2) bilinguals; ii) semantic priming effect will be smaller for Russian (L1)-English (L2) bilinguals compared to monolingual Russian (L1); and iii) semantic priming effect will be larger for Russian (L1)-English (L2) bilinguals compared to monolingual Russian (L1).

It therefore follows that if i) the size of semantic priming effect is the same for monolingual Russian (L1) and bilingual Russian (L1)-English (L2) speakers, it will be taken to indicate that having semantic networks (Collins & Quillian, 1969) in two different languages does not influence spreading activation (Collins & Loftus, 1975). If ii), then it will be assumed that nontarget language L2 is activated which has a negative influence on the semantic priming effect in the target language L1. If iii), this will be taken to indicate that although nontarget language L2 is activated, it has a positive or facilitatory effect on L1 semantic priming effect.

Evidence for (i) would support a two-store model where L1 and L2 are stored in semantic networks independent of each other (e.g., Potter et al., 1984). Evidence for (ii) and (iii) will be taken to indicate a common store (Paivio et al., 1988) as

depicted in the RHM by Kroll and Stewart (1994), one memory store for concepts for both languages.

A major methodological and theoretical consideration in Experiment 2, is therefore the measure of objective proficiency of the Russian (L1)-English (L2) bilinguals in their L2 (e.g., in English), using the Schonell reading test (1971). As discussed previously, according to the RHM direct access to meaning in L2 strengthens with proficiency. Therefore, the more proficient a bilingual is the more reliant they become on their direct L2 conceptual link for accessing meaning according to the RHM (Kroll & Stewart, 1994).

A highly proficient bilingual would therefore show comparable semantic priming effects in both L1 and L2, whereas a less proficient bilingual would show a smaller or null effect for semantic priming in L2. The procedure was the same as in Experiment 1 with the addition of the English (L2) language proficiency test using the Schonell Reading Test in English (Schonell, 1971).

The present study took objective proficiency measures into account for the first time to ascertain fluency in the two languages of the participants. Participants were asked to read words given in the test paper from left to right, from top to bottom as accurate as possible. If participants had difficulties with a pronunciation of a particular word he or she was asked to sound it out anyway. When participants were not able to say the word they were asked to go on to the next one. One mark was given for the each word correctly pronounced, even if the reader self-corrected.

The researcher did not correct participants and did not suggest a pronunciation. The number of errors was measured and the test was stopped if eight consecutive errors are made. This test had no time limit. The number of correct words and errors were compared with a normative table given in the test. Those participants who read correctly 75% of the words and above were taken to be proficient enough in English (L2). It is important to note that all the participants who took part in Experiment 2 were proficient in their L2.

Results

Data were analysed using descriptive statistics as can be seen in Table 3 and a repeated measures t-test which showed a statistically significant priming effect, i.e. statistically significant difference between related and unrelated target words in Russian (L1) for bilingual Russian (L1) - English (L2) speakers, $t(19)=4.04$ $p<0.001$. Error rates were less than 1% and therefore were not the subject of analyses.

The naming RTs from Experiments 1 and 2 were further analysed using a t-test as the descriptive statistics showed a large difference between monolingual (25ms) and bilingual (50ms) semantic priming effects in Russian (L1). The results confirmed that this difference was statistically significant $t\ (19) =2.2,\ p<0.04$.

Table 3. Descriptive statistics showing naming RTs in milliseconds and SD in related and unrelated Russian prime-target conditions in Experiment 2 for Russian (L1) - English (L2) bilinguals

Experimental Condition in Russian (L1)	Mean RTs	SD
Related	522	57
Unrelated	572	85
Magnitude of semantic priming	50	

Interim Discussion

The findings in Experiment 2 show a magnified semantic priming effect for bilingual Russian (L1) - English (L2) speakers compared to monolingual Russian speakers and are taken to indicate that semantic activation occurs automatically where activation of both L1 and L2 in bilinguals increases the priming effect. Furthermore, this effect can only come about if the two languages are activated from a single store (Altarriba & Basnight-Brown, 2007). It is also important to note that monolingual RTs to experimental conditions in Experiment 1 were notably faster to those in Experiment 2 although in both experiments participants responded to L1 prime-L1 target conditions.

Experiment 3

The aim of Experiment 3 is to examine semantic priming in English (L2) in Russian (L1) - English (L2) bilinguals.

Method

The experimental conditions were within-language in English (L2); that is, related and unrelated prime-target pairs were presented in English (L2) (e.g., doctor-cat and dog-nurse, respectively.) Naming RTs to target words were recorded together with errors.

Participants

The same Russian (L1) - English (L2) bilingual participants from Experiment 2 were recruited for the purpose of this experiment.

Materials and Procedure

A total of 42 trials were presented in English using SuperLab; 21 semantically related pairs (doctor-nurse, dog-cat); 21 unrelated pairs were formed by re-pairing

the stimuli in the related cases (e.g., doctor-cat, dog-nurse). Word frequencies in English were taken from the Celex Lexical Database (Baayen, Piepenbrock, & Van Rijn, 1993) using the combined written and spoken frequency measures of the word. The procedure was the same as in Experiment 2.

Results

As can be seen from Table 4, a difference of 46ms is observed between related and unrelated prime-targets when participants name targets in English (L2). Formal analysis of data showed a significant semantic priming effect [$t(19)=2.7$, $p<0.01$] in English (L2) for bilingual Russian (L1) - English (L2) speakers. Error rates were recorded but were too small for analyses (less than 1%).

Combined Analyses for Experiments 2 and 3 and Interim Discussion

Data from Experiments 2 and 3 were collapsed for analyses in order to examine the issue of storage in the bilingual memory. As highlighted previously, proficiency of bilinguals has been reported to influence the outcome of semantic priming effects (Kroll & Stewart, 1994). The Schonell Reading Test (1971) was employed to the Russian (L1) - English (L2) bilingual participants who took part in both Experiments 2 and 3.

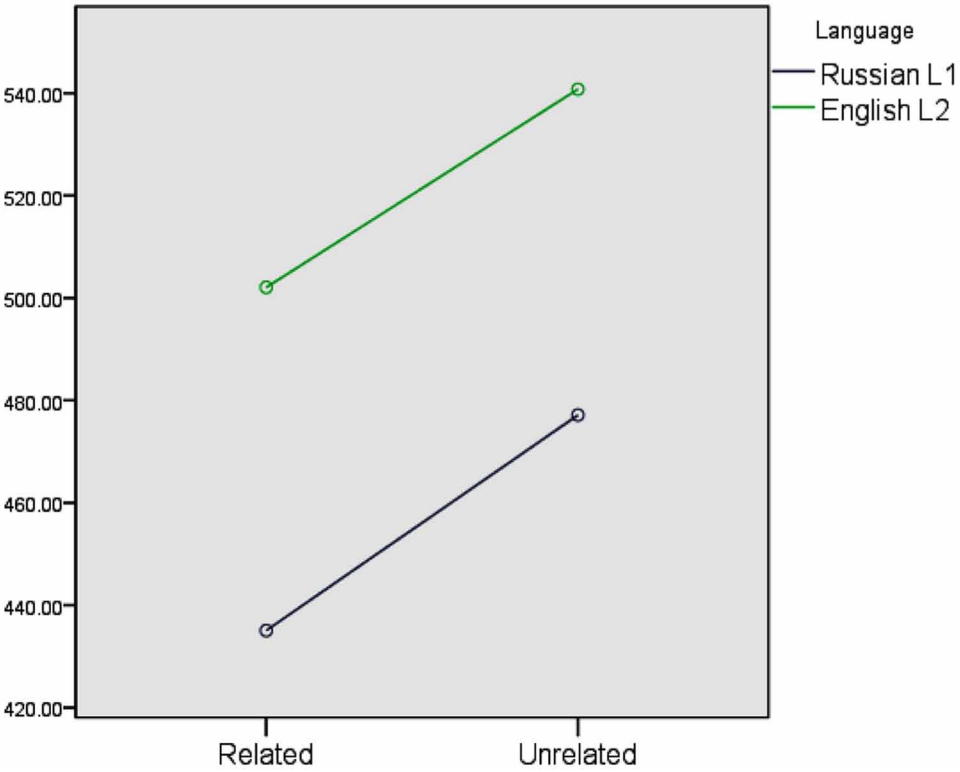
It was found that proficiency in English (L2) had a significant positive correlation with the magnitude of the semantic priming effect in Russian (L1) only, $r(20)=.57$ $p< 0.009$. The correlation between proficiency in L2 and semantic priming in L2 was nonsignificant ($p>0.05$).

As can be seen in Figure 1, despite showing a parallel and comparable semantic priming effect size in Russian (L1) and English (L2), Russian (L1) - English (L2) bilinguals are nevertheless slower in naming RTs in their second language English (L2) than their native language, Russian (L1). Moreover, a significant correlation was reported between proficiency in English (L2) and semantic priming effect size

Table 4. Descriptive statistics showing naming RTs in milliseconds and SD in related and unrelated English prime-target conditions in Experiment 3 for Russian (L1) - English (L2) bilinguals

Experimental Condition in English (L2)	Mean RTs	SD
Related	602	74
Unrelated	648	59
Magnitude of semantic priming	46	

Figure 1. Naming RTs under related and unrelated conditions for Russian (L1) - English (L2) bilinguals in Experiments 2 and 3



only in Russian (L1). This is taken as an indication of a) shared store for the two languages and b) the spreading activation where L1 and L2 are simultaneously and automatically activated thus benefiting the already strong links between L1 and their concepts according to the RHM (Kroll & Stewart, 1994).

In conclusion, the current set of experiments reported here provide evidence to support the claims of the bilingual RHM in that within-language effects were found for Russian (L1) - English (L2) bilingual participants in both their languages. Most importantly, the magnitude of the priming effect was found to be affected by proficiency in L2 indicating that the two languages are interconnected and affect each other's processes and activation. This is in line with current findings from other languages (for an overview see Lemhofer et al., 2008). It thus follows that if each of the bilinguals' languages were stored independent of each other none of these effects would have been reported.

The RHM (Kroll & Stewart, 1994) not only addresses the issue of organisation and storage of two representational systems, but it also takes into account the

proficiency of the second language (L2). This is an important factor as discussed in detail because it has implications on both the organisation and the processing of the two languages. An important note here is that all Russian (L1) - English (L2) bilingual participants recruited for Experiments 2 and 3 scored a high level of proficiency on the Schonell Reading test (1974) although they did not start learning English (L2) until nine years of age on average.

The magnitude of the semantic priming effect in Experiment 1 for monolinguals was smaller (25ms) compared to within-language (L1-L1) in Experiment 2 (50ms) and (L2-L2) in Experiment 3 (46ms). Based on the predictions above, these findings are in strong support of position (iii); namely, one memory store for concepts for both languages as depicted in the RHM by Kroll and Stewart (1994). The significant priming effect in English (L2) was also significantly associated with L2 proficiency confirming its contribution to the activation of semantic networks in bilingual memory.

With a careful consideration of the quite extensive literature on the topic of lexico-semantic processing, this study focused on examining how evidence from monolingual Russian speakers and bilingual Russian (L1) – English (L2) speakers could inform theories of visual word recognition and lexico-semantic organisation. However, given the absence of comparable studies conducted in Russian monolinguals and Russian (L1) – English (L2) bilinguals, one of the main challenges was the lack of psycholinguistic theoretical frameworks. The results of the current study have both theoretical and empirical importance which may lead for further research endeavours and practical implications in the area of lexico-semantic processing in monolingual and bilingual normative and clinical Russian speaking population.

In conclusion, semantic priming in naming is a universal phenomenon across the range of languages including Russian. This finding is in line with the predictions of the semantic activation hypothesis and is reported in single word naming in Russian for the first time. Furthermore, the notion that two languages of bilingual speakers are activated automatically via semantic activation was confirmed by finding that the magnitude of semantic priming effect in Russian bilinguals is larger than in monolinguals. Hence, the assumption can be made that bilingualism positively contributes to lexico-semantic processing.

REFERENCES

Abu-Rabia, S. (2001). Testing the interdependence hypothesis among native adult bilingual Russian-English students. *Journal of Psycholinguistic Research*, *30*(4), 437–455. doi:10.1023/A:1010425825251 PMID:11529524

Alario, F.-X., & Ferrand, L. (1999). A set of 400 pictures standardized for French: Norms for name agreement, image agreement, familiarity, visual complexity, image variability, and age of acquisition. *Behavior Research Methods, Instruments, & Computers*, *31*(3), 531–552. doi:10.3758/BF03200732 PMID:10502875

Altarriba, J., & Basnight-Brown, D. M. (2007). Methodological considerations in performing semantic-and translation-priming experiments across languages. *Behavior Research Methods*, *39*(1), 1–18. doi:10.3758/BF03192839 PMID:17552467

Baayen, H., Piepenbrock, R., & van Rijn, H. (1993). *The CELEX database on CD-ROM*. Philadelphia: Linguistic Data Consortium.

Barhudarov, S. E., & Dosycheva, E. I. (1940). *Грамматика русского языка. Часть первая. Фонетика и морфология* [Russian grammar. Part one. Phonetics and morphology]. Moscow, Russia: State Educational and Pedagogical Publishing.

Barry, C., Morrison, C. M., & Ellis, A. W. (1997). Naming the Snodgrass and Vanderwart pictures: Effects of age of acquisition, frequency, and name agreement. *The Quarterly Journal of Experimental Psychology: Section A*, *50*(3), 560–585. doi:10.1080/783663595

Basnight-Brown, D. M., & Altarriba, J. (2007). *Methodological considerations in performing semantic-and translation-priming experiments across languages*. Academic Press.

Bialystok, E. (2001). Metalinguistic aspects of bilingual processing. *Annual Review of Applied Linguistics*, *21*, 169–181. doi:10.1017/S0267190501000101

Bialystok, E., & Hakuta, K. (1994). *In other words: The science and psychology of second-language acquisition*. New York: Basic Books.

Bril, A., & Green, R. (2013). Bilingual Stroop in English Speakers with Russian as a Second Language: Exploring the Model of the Bilingual Mind. *FIVE: The Claremont Colleges Journal of Undergraduate Academic Writing*, *2*(1), 3. doi:10.5642/five.20130201.03

Brysbaert, M., Ameel, E., & Storms, G. (2014). Bilingual Semantic Memory: A New Hypothesis. In *Foundations of Bilingual Memory* (pp. 133–146). New York: Springer. doi:10.1007/978-1-4614-9218-4_7

Chen, H. C., & Ho, C. (1986). Development of stroop interference in Chinese-English bilinguals. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *12*(3), 397–401. doi:10.1037/0278-7393.12.3.397

Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic processing. *Psychological Review*, *82*(6), 407–428. doi:10.1037/0033-295X.82.6.407

Collins, A. M., & Quillian, M. R. (1969). Retrieval time from semantic memory. *Journal of Verbal Learning and Verbal Behavior*, *8*(2), 240–247. doi:10.1016/S0022-5371(69)80069-1

Coltheart, M. (1978). Lexical access in simple reading tasks. Strategies of Information Processing, 151-216.

Crystal, D. (2008). Two thousand million? *English Today*, *24*(01), 3–6. doi:10.1017/S0266078408000023

Cubberley, P. (2002). *Russian: A linguistic introduction*. Cambridge, MA: Cambridge University Press.

de Groot, A. M., Delmaar, P., & Lupker, S. J. (2000). The processing of interlexical homographs in translation recognition and lexical decision: Support for non-selective access to bilingual memory. *The Quarterly Journal of Experimental Psychology: Section A*, *53*(2), 397–428. doi:10.1080/713755891 PMID:10881612

Dijkstra, T., Van Jaarsveld, H., & Brinke, S. T. (1998). Interlingual homograph recognition: Effects of task demands and language intermixing. *Bilingualism: Language and Cognition*, *1*(01), 51–66. doi:10.1017/S1366728998000121

Dimitropoulou, M., Duñabeitia, J. A., Blitsas, P., & Carreiras, M. (2009). A standardized set of 260 pictures for Modern Greek: Norms for name agreement, age of acquisition, and visual complexity. *Behavior Research Methods*, *41*(2), 584–589. doi:10.3758/BRM.41.2.584 PMID:19363201

Dyer, F. (1971). Color-naming interference in monolinguals and bilinguals. *Journal of Verbal Learning and Verbal Behavior*, *10*(3), 297–302. doi:10.1016/S0022-5371(71)80057-9

Egorov, T. G. (2006). *Психология овладения навыком чтения* [The psychology of reading acquisition]. St. Petersburg, Russia: KARO.

Francis, W. S. (1999). Cognitive integration of language and memory in bilinguals: Semantic representation. *Psychological Bulletin*, *125*(2), 193–222. doi:10.1037/0033-2909.125.2.193 PMID:10087936

Grigorenko, E. L. (2010). *Report on the Russian Language for the world dyslexia forum*. Yale University, Columbia University, and Moscow State University, Russia.

Grosjean, F. (1997). The bilingual individual. *Interpreting*, *2*(1-2), 163–187. doi:10.1075/intp.2.1-2.07gro

Harley, T. A. (2013). *The psychology of language: From data to theory*. New York: Psychology Press.

Huebler, F., & Lu, W. (2013). *Adult and Youth Literacy: National, Regional and Global Trends, 1985-2015*. Academic Press.

Hutchison, K. A. (2003). Is semantic priming due to association strength or feature overlap? A microanalytic review. *Psychonomic Bulletin & Review*, *10*(4), 785–813. doi:10.3758/BF03196544 PMID:15000531

Iliev, I. G. (2013). Short History of the Cyrillic Alphabet. *International Journal of Russian Studies*, *2*(2), 1–65.

Jared, D., & Kroll, J.F. (2001). Do bilinguals activate phonological representations in one or both of their languages when naming words? *Journal of Memory and Language, 44*, 2-31.

Kerek, E., & Niemi, P. (2009a). Russian orthography and learning to read. *Reading in a Foreign Language*, *21*(1), 1–21.

Kerek E., & Niemi P. (2009b). Learning to read in Russian: effects of orthographic complexity. *Journal of Research in Reading, Volume, 32*(2), 157–179. DOI: 10.1111/j.1467-9817.2008.01390.x

Kornev, A. N. (1995). *Дислексия и дисграфия у детей* [Dyslexia and dysgraphia in children]. St. Petersburg, Russia: MiM.

Kornev, A. N. (2003). *Нарушения чтения и письма у детей* [Difficulties in reading and writing in children]. St. Petersburg, Russia: Rech.

Kornev, A. N., Rakhlin, N., & Grigorenko, E. L. (2010). Dyslexia From a Cross-Linguistic and Cross-Cultural Perspective: The Case of Russian and Russia. *Learning Disabilities (Weston, Mass.)*, *8*(1), 41–69.

Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, *33*(2), 149–174. doi:10.1006/jmla.1994.1008

Lemhöfer, K., Dijkstra, T., Schriefers, H., Baayen, R. H., Grainger, J., & Zwitserlood, P. (2008). Native language influences on word recognition in a second language: A megastudy. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *34*(1), 12–31. doi:10.1037/0278-7393.34.1.12 PMID:18194052

Lyashevskaya, O., & Sharov, S. (2009). *The frequency dictionary of modern Russian language*. Moscow, Russia: Azbukovnik.

MacLeod, C. M. (1991). Half a century of research on the Stroop effect: An integrative review. *Psychological Bulletin*, *109*(2), 163–203. doi:10.1037/0033-2909.109.2.163 PMID:2034749

Marian, V., Blumenfeld, H. K., Mizrahi, E., Kania, U., & Cordes, A.-K. (2013). Multilingual Stroop performance: Effects of trilingualism and proficiency on inhibitory control. *International Journal of Multilingualism*, *10*(1), 82–104. doi:10.1080/14790718.2012.708037 PMID:24039546

McNamara, T. P., & Holbrook, J. B. (2003). *Semantic memory and priming*. Handbook of psychology. doi:10.1002/0471264385.wei0416

Meyer, D. E., & Schvaneveldt, R. W. (1971). Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. *Journal of Experimental Psychology*, *90*(2), 227–234. doi:10.1037/h0031564 PMID:5134329

Morton, J. (1969). Interaction of information in word recognition. *Psychological Review*, *76*(2), 165–178. doi:10.1037/h0027366

Neely, J. H. (1977). Semantic priming and retrieval from lexical memory: Roles of inhibitionless spreading activation and limited-capacity attention. *Journal of Experimental Psychology. General*, *106*(3), 226–254. doi:10.1037/0096-3445.106.3.226

Neely, J. H. (1991). Semantic priming effects in visual word recognition: A selective review of current findings and theories. *Basic Processes in Reading: Visual Word Recognition, 11*, 264-336.

Neely, J. H., & Kahan, T. A. (2001). Is semantic activation automatic? A critical re-evaluation. In H. L. Roediger III, J. S. Nairne, I. Neath, & A. M. Surprenant (Eds.), *Science conference series. The nature of remembering: Essays in honor of Robert G. Crowder* (pp. 69–93). Academic Press. doi:10.1037/10394-005

Niolaki, G. Z., Masterson, J., & Terzopoulos, A. R. (2014). Spelling improvement through letter-sound and whole-word training in two multilingual Greek-and English-speaking children. *Multilingual Education*, *4*(1), 1–23. doi:10.1186/s13616-014-0020-3

Nishimoto, T., Miyawaki, K., Ueda, T., Une, Y., & Takahashi, M. (2005). Japanese normative set of 359 pictures. *Behavior Research Methods*, *37*(3), 398–416. doi:10.3758/BF03192709 PMID:16405135

Nisi, M., Longoni, A. M., & Snodgrass, J. G. (2000). Italian measurement on the relation of name, familiarity, and acquisition age for the 260 figures of Snodgrass and Vanderwart. *Giornale Italiano di Psicologia*, *27*, 205–218.

Paivio, A., Clark, J. M., & Lambert, W. E. (1988). Bilingual dual-coding theory and semantic repetition effects on recall. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *14*(1), 163–172. doi:10.1037/0278-7393.14.1.163

Pind, J., Jónsdóttir, H., Tryggvadóttir, H. B., & Jónsson, F. (2000). Icelandic norms for the Snodgrass and Vanderwart (1980) pictures: Name and image agreement, familiarity, and age of acquisition. *Scandinavian Journal of Psychology*, *41*(1), 41–48. doi:10.1111/1467-9450.00169 PMID:10731842

Potter, M. C., So, K. F., Von Eckardt, B., & Feldman, L. B. (1984). Lexical and conceptual representation in beginning and proficient bilinguals. *Journal of Verbal Learning and Verbal Behavior*, *23*(1), 23–38. doi:10.1016/S0022-5371(84)90489-4

Potter, M. C., So, K. F., Von Eckardt, B., & Feldman, L. B. (1984). Lexical and conceptual representation in beginning and proficient bilinguals. *Journal of Verbal Learning and Verbal Behavior*, *23*(1), 23–38. doi:10.1016/S0022-5371(84)90489-4

Preston, M. S., & Lambert, W. E. (1969). Interlingual interference in a bilingual version of the Stroop color-word task. *Journal of Verbal Learning and Verbal Behavior*, *8*(2), 295–301. doi:10.1016/S0022-5371(69)80079-4

Raman, I., Raman, E., Ikier, S., Kilecioglu, E., Uzun, D., & Zeyveli, S. (under review). Differential Effects of Age of Acquisition and Frequency on Memory. *Evidence from Free Recall of Pictures and Words in Turkish*.

Raman, I., Raman, E., & Mertan, B. (2014). A standardised set of 260 pictures for Turkish: Norms of name and image agreement, age of acquisition, visual complexity and conceptual familiarity. *Behavior Research Methods*, *46*(2), 588–595. doi:10.3758/s13428-013-0376-4 PMID:23943583

Roberts, S. G. (2013). *Evolutionary approach to bilingualism* (PhD thesis). University of Edinburgh, United Kingdom.

Roelofs, A. (2009). Attention and Facilitation: Converging Information Versus Inadvertent Reading in Stroop Task Performance. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *36*(2), 411–422. doi:10.1037/a0018523 PMID:20192539

Rosselli, M., Ardila, A., Santisi, M. N., Arecco, M. D. R., Salvatierra, J., Conde, A., & Lenis, B. O. N. I. E. (2002). Stroop effect in Spanish–English bilinguals. *Journal of the International Neuropsychological Society*, *8*(06), 819–827. doi:10.1017/S1355617702860106 PMID:12240746

Rossion, B., & Pourtois, G. (2004). Revisiting Snodgrass and Vanderwart's object pictorial set: The role of surface detail in basic-level object recognition. *Perception*, *33*(2), 217–236. doi:10.1068/p5117 PMID:15109163

Sanfeliù, M. C., & Fernandez, A. (1996). A set of 254 Snodgrass–Vanderwart pictures standardized for Spanish: Norms for name agreement, image agreement, familiarity, and visual complexity. *Behavior Research Methods, Instruments, & Computers*, *28*(4), 537–555. doi:10.3758/BF03200541

Scarborough, D. L., Gerard, L., & Cortese, C. (1984). Independence of lexical access in bilingual word recognition. *Journal of Verbal Learning and Verbal Behavior*, *23*(1), 84–99. doi:10.1016/S0022-5371(84)90519-X

Schonell, F. J. (1971). *Reading and Spelling Tests*. Edinburgh, UK: Oliver and Boyd.

Schoonbaert, S., Duyck, W., Brysbaert, M., & Hartsuiker, R. J. (2009). Semantic and translation priming from a first language to a second and back: Making sense of the findings. *Memory & Cognition*, *37*(5), 569–586. doi:10.3758/MC.37.5.569 PMID:19487749

Seidenberg, M. S., & McClelland, J. L. (1989). A distributed, developmental model of word recognition and naming. *Psychological Review*, *96*(4), 523–568. doi:10.1037/0033-295X.96.4.523 PMID:2798649

Shi, X. (2007). Intercultural Language Socialization: Theory and Methodology. *Intercultural Communication Studies*, *16*(1), 230.

Sholl, A., Sankaranarayanan, A., & Kroll, J. F. (1995). Transfer between picture naming and translation: A test of asymmetries in bilingual memory. *Psychological Science*, *6*(1), 45–49. doi:10.1111/j.1467-9280.1995.tb00303.x

Snodgrass, J. G., & Vanderwart, M. (1980). A standardized set of 260 pictures: Norms for name agreement, image agreement, familiarity, and visual complexity. *Journal of Experimental Psychology. Human Learning and Memory*, *6*(2), 174–215. doi:10.1037/0278-7393.6.2.174 PMID:7373248

Stroop, J. R. (1935). Studies in interference in serial verbal reactions. *Journal of Experimental Psychology*, *18*(6), 643–661. doi:10.1037/h0054651

Sumiya, H., & Healy, A. F. (2004). Phonology in the bilingual Stroop effect. *Memory & Cognition*, *32*(5), 752–758. doi:10.3758/BF03195865 PMID:15552352

Tabossi, P., & Laghi, L. (1992). Semantic priming in the pronunciation of words in two writing systems: Italian and English. *Memory & Cognition*, *20*(3), 303–313. doi:10.3758/BF03199667 PMID:1508055

Therriault, D. J., Yaxley, R. H., & Zwaan, R. A. (2009). The role of color diagnosticity in object recognition and representation. *Cognitive Processing*, *10*(4), 335–342. doi:10.1007/s10339-009-0260-4 PMID:19471986

Tsaparina, D., Bonin, P., & Méot, A. (2011). Russian norms for name agreement, image agreement for the colorized version of the Snodgrass and Vanderwart pictures and age of acquisition, conceptual familiarity, and imageability scores for modal object names. *Behavior Research Methods*, *43*(4), 1085–1099. doi:10.3758/s13428-011-0121-9 PMID:21717267

Tzelgov, J., Henik, A., & Leiser, D. (1990). Controlling Stroop interference: Evidence from a bilingual task. *Journal of Experimental Psychology*, *16*, 760–771.

Voga, M., & Grainger, J. (2007). Cognate status and cross-script translation priming. *Memory & Cognition*, *35*(5), 938–952. doi:10.3758/BF03193467 PMID:17910178

Volkovyskaya, E., Raman, I., & Baluch, B. (under review). Age of Acquisition (AoA) effect in monolingual Russian speakers and bilingual Russian (L1) - English (L2) speakers in a free recall task. *Writing Systems Research Journal*.

Weber, G. (1997). Top Language. *Language Monthly*, (3).

Weekes, B. S., Shu, H., Hao, M., Liu, Y., & Tan, L. H. (2007). Predictors of timed picture naming in Chinese. *Behavior Research Methods*, *39*(2), 335–342. doi:10.3758/BF03193165 PMID:17695362

Woods, C. (2006). Bilingualism, Scribal Learning, and the Death of Sumerian. In S. L. Sanders (Ed.), Margins of Writing, Origins of Culture (pp. 91–120). Chicago: Academic Press.